

MISSOURI SHORLEAF PINE UTILIZATION ASSESSMENT

The *Missouri Shortleaf Pine Utilization Assessment* serves as a comprehensive and strategic resource for the Forest and Woodland Association of Missouri (FWAM), federal and state agencies, loggers, sawmills, and secondary wood product manufacturers by identifying key opportunities to expand markets for Missouri-grown shortleaf pine. This report provides data-driven insights to drive targeted growth in shortleaf pine manufacturing, empowering stakeholders to enhance economic viability, strengthen forest management, and improve industry competitiveness while supporting multi-tiered landscape restoration and ecological objectives.

FWAM initiated this study with the Missouri Department of Conservation, the L-A-D Foundation, and the Mark Twain National Forest to address market constraints and the underutilization of Missouri’s shortleaf pine resource. By evaluating current and emerging market trends, industry capacity, and production feasibility, this assessment provides a clear roadmap for investment, innovation, and sustainable market expansion. Strengthening markets will, in turn, support state-led priorities – such as those outlined in Missouri’s Comprehensive Conservation Strategy (CCS) – while advancing broader landscape restoration goals, such as those established in the Shortleaf Pine Initiative (SPI) “Shortleaf Pine Restoration Plan.” By integrating these objectives, this assessment presents a strategic framework that balances economic growth, forest restoration, and the long-term sustainability of Missouri’s shortleaf pine resource.



Shortleaf Pine Harvest | Mark Twain National Forest Timber Sale
Photo Credit: Ross, H. (2024). Renewable Resource Solutions, LLC. [Unpublished photographs].

KEY FINDINGS

Missouri’s Shortleaf Pine Resource & Historical Context

Shortleaf pine (*Pinus echinata*) is Missouri’s only native pine species, historically covering over 6 million acres before widespread logging, fire suppression, and land-use conversion in the late 19th and early 20th centuries (MDC, 2020). As of 2023, only a small percentage of those acres remain, primarily in the southern portion of the state.

Missouri’s shortleaf pine forests historically supported a thriving timber industry, providing raw materials for construction, furniture, and railroad ties. The Grandin Sawmill, once the largest in the U.S., processed shortleaf pine to help support the demand for construction timber and other forest products for booming populations in eastern and port cities (Dey, 2022).

Ecological Importance & Forest Management Challenges

Shortleaf pine forests play a vital role in enhancing biodiversity, providing critical wildlife habitat, improving watershed stability, and contributing to carbon sequestration (U.S. Forest Service, 2020). Unlike many hardwood species, shortleaf pine is resilient to frequent fire, making it an essential component of fire-adapted ecosystems.

Without periodic fire or active management, hardwoods such as oak and hickory outcompete shortleaf pine, limiting its regeneration. Leaf litter exceeding 2.5 inches in depth prevents shortleaf pine germination, further inhibiting natural regeneration. Prescribed burning, mechanical site preparation, and sustainable harvesting practices are necessary to maintain and restore shortleaf pine forests. Burning and harvesting operations expose mineral soil, providing the optimal conditions for shortleaf pine seed germination.

Forest Resources & Industry Impact

Missouri encompasses approximately 14.9 million acres of timberland which is largely concentrated in the southern portion of the state – identified in this assessment as the Ozark and Southeast regions. Most of Missouri’s timberlands (71%) are privately owned - including 143,880 acres on the L-A-D Foundation’s Pioneer Forest. The Mark Twain National Forest accounts for 9% and state-owned lands 4%. The remaining timberland is held by “other” ownerships (local municipalities, other federal agencies, etc.).

Missouri’s forest products industry plays a critical role in the state’s economy, supporting thousands of jobs, generating significant tax revenue, and contributing billions in economic output. In 2023, the forest products, wood, lumber, paper, and related industries contributed \$11.7 billion to Missouri’s economy and supported approximately 37,500 jobs with a combined payroll exceeding \$2.7 billion and generate \$920 million in total tax revenue (Treiman, 2024).

Shortleaf Pine Availability & Harvest Potential

While most land is privately owned, most of the shortleaf pine trees are on federal lands; there are 71.6 million shortleaf pine trees in the state and 35.6 million (50%) of them are on National Forest System lands. Those trees contain 1.41 billion cubic feet of wood, and of that, 1.15 billion cubic feet is in sawlog material.

The majority of shortleaf pine trees are in middle-aged stands (61-90 years), representing 53.6% of total growing stock. In contrast, early-stage recruitment (0-30 years) is just 3.5%, indicating a potential regeneration bottleneck.

Nearly 77% of the shortleaf pine trees are pole timber and fall within the 5-12.9” range, with the most trees in the 9.1-10” d.b.h range. Shortleaf pine reaches merchantable sawtimber size at 9 inches d.b.h., with the highest concentration of trees occurring at this threshold. The decline in tree count occurring between 9 and 15 inches is likely attributed to selective harvesting, whereas reductions beyond 15 inches are more likely due to site limitations and natural mortality.

Shortleaf pine is dispersed across various terrains and its accessibility could be limited by buffers around open surface waters, steep slopes, and small parcel sizes which would likely impact the economic feasibility of timber harvesting. Considering these limitations, at least 75% of the volume is readily available for harvest.

MISSOURI’S
SHORTLEAF PINE RESOURCES
(FIA, 2019)

71.6 Million
SHORTLEAF PINE TREES

50% shortleaf pine trees are located within the Mark Twain National Forest (35.6 million trees)

1.41 Billion
CUBIC FEET OF SHORTLEAF PINE

with 1.15 billion cubic feet of sawlog material

90%
OF SHORTLEAF PINE
SAWLOGS ARE IN THE OZARK AND
SOUTHEASTERN REGION

total of 1.02 billion cubic feet

MISSOURI’S SHORTLEAF PINE
RESOURCES ARE
75% Accessible

when considering accessibility limitations of open surface water buffers, steep slopes, and small parcel sizes

56%
OF SHORTLEAF PINE
ARE MIDDLE-AGED STANDS

shortleaf pine growing stock is concentrated between 61-90 years old

77%
OF SHORTLEAF PINE
IS POLE TIMBER

the shortleaf pine resource is largely pole timber (5-12.9” d.b.h. range), with most trees in the 9.1-10” d.b.h range

MISSOURI'S SHORTLEAF PINE GROWTH	
36.9 Million CUBIC FEET OF SHORTLEAF SAWTIMBER GROWTH PER YEAR and 1.3 million cubic feet/year of growth in other size classes	
3.03 Billion CUBIC FEET OF SHORTLEAF SAWTIMBER VOLUME IN 30 YEARS	
PROJECTED 30-YEAR SUSTAINABLE HARVEST VOLUMES	
CURRENT HARVEST RATE 3.0 Million Cubic Feet of Shortleaf Growing Stock	
HARVEST 2% OF STANDING VOLUME 9.3 Million Cubic Feet of Shortleaf Growing Stock	
HARVEST 3% OF STANDING VOLUME 1.25 Billion Cubic Feet of Shortleaf Growing Stock	

Growth Trends & Sustainability

Annual growth of shortleaf pine sawtimber is estimated at 36.9 million cubic feet per year and non-sawlog material is estimated at 1.3 million cubic feet annually. Given these growth rates, the volume of the sawlog material is expected to approximately double in 30 years to 3.03 billion cubic feet if current harvest rates continue.

Growth-to-drain ratios indicate the balance between timber growth and removals, with a ratio greater than 1 signifying growth exceeding harvest and less than 1 indicating a net loss of volume. At current annual harvest levels, county-level growth-to-drain ratios remain highly variable and erratic, with some counties showing substantial growth with no removals, highlighting underutilized timber resources.

To assess sustainable harvest levels, two scenarios were analyzed:

- Harvesting 2% of standing volume over 30 years resulted in growth exceeding removals in most counties, yielding growth-to-drain ratios between 0.55 – 3.15 and annual harvest volumes ranging from ~259,000 – 1.4 million cubic feet at the county level. Total harvest volume at this level would be 9.3 million cubic feet.
- A projected harvest of 3% of the standing volume over 30 years indicated that removals would slightly outpace growth. Under this scenario, annual harvest volumes would range from ~340,000 - 1.8 million cubic feet, totaling 1.25 billion cubic feet harvested over 30 years.

These findings indicate the substantial volume potentially available for use and emphasize the need for strategic harvest planning to ensure long-term sustainability of the forest and the forest products industry.

Forest Industry Production

Missouri’s forest products industry is primarily focused on hardwood lumber production, with limited softwood production occurring. However, hardwood lumber manufacturers increasingly face challenges in selling softwood logs from mixed timber sales. Additionally, the state's forest products manufacturing facilities have been in decline, mirroring national industry trends.

In 2022, Missouri’s total roundwood production was 2.6 million cubic feet, with 94% attributed to hardwoods. Despite having in-state softwood resources, Missouri imports approximately 55,000 tons of roundwood annually, including shortleaf pine, as reported by manufacturing facilities during site visits. This highlights an opportunity to increase utilization of locally available shortleaf pine within existing markets.

Lumber Strength Study

While plantation-grown pine varieties dominate the modern timber market, there is an opportunity to separate Missouri-grown shortleaf pine from plantation-grown shortleaf pine as a sustainable and high-performance lumber resource. The mechanical properties of southern yellow pine (SYP) wood from plantation pines are known to be inferior to those from old growth forests, where trees grow slower, though there is no data specifically on Missouri-grown shortleaf pine. A study was conducted to assess the mechanical properties of shortleaf pine lumber sourced from non-plantation forests in Missouri through a combination of non-destructive and destructive tests.

Recommendations for Market Development

To maximize the **economic and ecological benefits** of shortleaf pine restoration, the following strategies are recommended:

1. **Expand Market Utilization:** The versatility of shortleaf pine makes it well-suited for structural timber, engineered wood, and biomass energy applications. Diversifying its market potential will ensure logs of various sizes and quality, as well as processing residues, can be utilized effectively.
2. **Enhance Processing Infrastructure:** Current softwood production capacity would need to be increased to accommodate a large pine market expansion. Investments in milling, drying, and transportation facilities is essential to improve efficiency and create new economic opportunities for shortleaf pine. Addressing the capacity of softwood processing and kiln drying capacity is critical for expanding utilization. Hardwood sawmills could consider transitioning their equipment and sawing strategies to encompass both hardwood and softwood, allowing for enhanced production flexibility and output potential.
3. **Strengthen Industry Collaboration:** Establishing stronger partnerships between loggers, mill owners, conservation groups, and policymakers is essential for coordinated industry expansion. Many industry members reported operating in isolation, limiting opportunities for infrastructure growth. The independent spirit of Missouri's forest industry members can be harnessed toward the common goal to collaboratively market shortleaf pine with a branding initiative, such as *"Missouri Shortleaf Pine – Strength Rooted in Tradition."* Securing funding to build a Missouri Wood Innovation Team through the U.S. Forest Service's Wood Innovation Program is a next step to developing this coalition.
4. **Expanded Markets**
 - **Biomass, Energy & Bioproducts:** Increase utilization of chips, shavings, pellets, and wood flour for renewable energy and bioproduct applications.
 - **Infrastructure Applications:** Develop markets for highway guardrails, signposts, timber bridges, cross ties, and marine applications, leveraging shortleaf pine's durability and structural properties.
 - **Engineered & Industrial Wood Products:** Promote the use of shortleaf pine for pallets, mass timber, and industrial wood products, aligning with national trends in sustainable building materials.
 - **Lumber & Architectural Applications:** Increase demand for high-quality lumber and architectural wood pieces, emphasizing Missouri-grown shortleaf pine's sustainability and aesthetic appeal.



Missouri-Grown Shortleaf Lumber
Photo Credit: Renewable Resource Solutions, LLC. (2025).

CONCLUSION

Missouri's shortleaf pine resource is a valuable yet underutilized economic and ecological asset. Through strategic management practices and targeted market expansion, stakeholders can drive economic growth while ensuring the long-term sustainability of this vital forest ecosystem. Collaboration among industry leaders, landowners, and policymakers will be essential to building a resilient and competitive shortleaf pine market in Missouri. This executive summary highlights key insights from the assessment, providing a high-level overview of the resource's potential. The full report offers a comprehensive analysis, including regional data breakdowns, growth projections, and industry resources to support informed decision-making and strategic development.